



# Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Flexible Concealed Water-Containment Membrane<sup>1</sup>

This standard is issued under the fixed designation D4551; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

## 1. Scope\*

1.1 This specification covers poly(vinyl chloride) (PVC) flexible sheeting which is used without mastic, bedding, or coating for construction of concealed water-containment-membranes in applications where there is potential for costly secondary damage from water leakage and very long-term reliable performance is essential. Examples are fountains, pools, planters, shower and safe pans, tile tubs, or similar wet installations where the membrane is inaccessible once the construction is complete. Included are requirements for materials and sheeting, test methods, workmanship criteria, and methods of marking.

1.2 Recycled materials may be used in this product in accordance with the requirements in Section 5.

1.3 The tests are intended to ensure quality and performance and are not intended for design purposes. Tests have been selected to be conducted primarily with liquids that simulate the environment to which the membrane will be subjected during actual use.

1.4 This specification does not cover water-containment membranes exposed to ultraviolet light.

1.5 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.6 There is no known ISO equivalent to this standard.

1.7 The following precautionary caveat pertains only to the test method portion, Section 11, of this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.8 *This international standard was developed in accordance with internationally recognized principles on standard-*

*ization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

D374/D374M Test Methods for Thickness of Solid Electrical Insulation

D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

D543 Practices for Evaluating the Resistance of Plastics to Chemical Reagents

D618 Practice for Conditioning Plastics for Testing

D883 Terminology Relating to Plastics

D1004 Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting

D1203 Test Methods for Volatile Loss from Plastics Using Activated Carbon Methods

D1204 Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature

D1243 Test Method for Dilute Solution Viscosity of Vinyl Chloride Polymers

D1600 Terminology for Abbreviated Terms Relating to Plastics

D3892 Practice for Packaging/Packing of Plastics

E96/E96M Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials

### 2.2 ANSI Standard:

Z 26.1 Safety Code for Safety Glazing Materials for Glazing Motor Vehicles Operating on Land Highways<sup>3</sup>

### 2.3 Military Standard:

MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes<sup>4</sup>

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.24 on Plastic Building Products.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

<sup>4</sup> Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

### 3. Terminology

#### 3.1 Definitions:

3.1.1 *General*—For definitions of terms that appear in this specification relating to plastics, refer to Terminology D883. For abbreviations that appear in this specification, refer to Terminology D1600, unless otherwise indicated.

#### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *water-containment membrane, n*—a non-porous membrane impervious to water and resistant to permeation by water vapor to an extent that it provides a high degree of certainty that secondary damage from leakage shall not occur.

3.2.2 *homogeneous sheeting, n*—sheeting that is of uniform composition throughout its thickness.

### 4. Classification

4.1 The sheeting will be subdivided by grades based on thickness:

4.1.1 *Grade 30*—0.03 in. (0.77 mm).

4.1.2 *Grade 40*—0.04 in. (1.02 mm).

### 5. Materials and Manufacture

5.1 This specification covers poly(vinyl chloride) (PVC) water-containment membrane formulated from PVC materials meeting the following requirements:

5.1.1 A PVC resin with an inherent viscosity (logarithmic viscosity number) of not less than 0.92 as determined by Test Method D1243.

5.1.2 A PVC compound density of 1.26/1.29 g/cm<sup>3</sup>.

5.2 Recycle materials, used in this product shall meet all the requirements in Sections 3, 5, 6, and 9.

5.3 The use of water-soluble compounding ingredients shall be prohibited.

5.4 Plasticizers that are resistant to migration, mildew, and bacterial degradation shall be used.

### 6. Physical Properties

6.1 The sheeting shall conform to the physical requirements prescribed in Section 9 (Table 1) and Section 15 (Table 2).

TABLE 2 Quality Assurance Requirements

| Property           | Unit          | Specification<br>Grade 30 | Specification<br>Grade 40 |
|--------------------|---------------|---------------------------|---------------------------|
| Thickness          | in. (mm)      | 0.030 (0.765), min        | 0.040 (1.02), min         |
| Pinholes           | number        | none                      | none                      |
| Shrinkage at 158°F | % of original | 5 %, max                  | 5 %, max                  |
| Width              | in. (cm)      | +0.5 (1.27), −0.0         | +0.5 (1.27), −0.0         |

6.2 Sheetting shall be compounded so that bonds between sheets used in fabrication of large water-containment membranes can be accomplished in the field without reducing the overall resistance of the membrane to permeation or leakage or significantly reducing the sheeting's physical strength. The manufacturer shall specify recommended bonding procedures in its product literature.

6.3 The sheeting shall be monolithic and homogeneous.

### 7. Dimensions

7.1 Minimum thickness of Grade 30 sheeting shall be 0.03 in. (0.765 mm) and minimum thickness of Grade 40 sheeting shall be 0.04 in. (1.02 mm).

### 8. Workmanship

8.1 The sheet shall be inspected for appearance, thickness, width, and workmanship. The material shall be free of pin holes, foreign inclusions, undispersed materials, or other defects that could affect serviceability.

### 9. Qualification Tests

9.1 The PVC sheeting shall pass all the qualification tests prescribed in Section 11 and Table 1.

### 10. Sampling

10.1 Test specimens shall be selected at random from production stock. In each roll selected, units comprising the required number of specimens shall be taken from a portion not including the first or last foot of the roll or portions within 6 in. of the edge of the roll.

TABLE 1 Qualification Tests

| Property                           | Unit                    | Specification      |                   |
|------------------------------------|-------------------------|--------------------|-------------------|
|                                    |                         | Grade 30           | Grade 40          |
| Thickness                          | in. (mm)                | 0.030 (0.765), min | 0.040 (1.02), min |
| Tensile strength                   | lbf/in. (kN/m) of width | 60 (10.45), min    | 80 (14.05), min   |
| Tensile stress at 100 % elongation | lbf/in. (kN/m) of width | 30 (5.23), min     | 40 (7.03), min    |
| Elongation at break                | %                       | 300, min           | 300, min          |
| Tear resistance                    | lbf/in. (kN/m) of width | 185 (32.5), min    | 250 (43.7), min   |
| Pinholes                           | number                  | none               | none              |
| Micro-organism resistance          | specimen, pass/fail     | 12 of 12 pass      | 12 of 12 pass     |
| Puncture resistance                | specimen, pass/fail     | 6 of 6 pass        | 6 of 6 pass       |
| Indentation resistance             | specimen, pass/fail     | 3 of 3 pass        | 3 of 3 pass       |
| Folding resistance                 | specimen, pass/fail     | 3 of 3 pass        | 3 of 3 pass       |
| Chemical resistance                |                         |                    |                   |
| Distilled H <sub>2</sub> O         | % weight change         | +1 %, max          | +1 %, max         |
| Soapy H <sub>2</sub> O             | % weight change         | +2 %, max          | +2 %, max         |
| Alkali                             | specimen, pass/fail     | 3 of 3 pass        | 3 of 3 pass       |
| Hydrostatic pressure test          | specimen, pass/fail     | 3 of 3 pass        | 3 of 3 pass       |
| Shrinkage                          | % original              | 5 %, max           | 5 %, max          |
| Volatile loss at 158°F             | % loss                  | 1.5 max            | 1.5 max           |